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An Analysis of E-commerce Applied to the Management of Hospitality Industry Based on Optimal Solutions

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Abstract

At present total usually charges the retailers the same per-unit cost for drop shipping as the regular replenishment orders. The drop-shipping option is only currently offered to large retail customers. The hospitality industry is contemplating offering drop shipping to all its retail customers at a premium over the per-unit cost of the regular replenishment orders. The problem the retailers facing is to develop an inventory policy which takes into account the drop-shipping option. In order to investigate the effect of inventory pattern on non-perishable inventory systems, we can consider using the quantity reorder-point inventory pattern in a continuous-review order. In this paper, hospitality industry will be researched in which condition that the retailers use an inventory pattern option when a shortage occurs during lead-time. And we can derive closed-form expressions for the optimal solutions under exponential and uniform demand distributions.

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1. Introduction

Hospitality industry has significant advantages for the retailer over holding inventory for the tourism. These advantages include savings in holding cost, significant reductions in processing costs and increasing tourism customer satisfaction as a result of better tourism service. According to Huppertz , "direct store delivery (DSD) or drop shipping is how some trading partners avoid the cost of handling smaller orders in a retailer's or a distributor's distribution center. By letting the supplier ship the order directly to the store or end customer, a whole step is removed from the supply chain and the retailers (or buyers) achieve their objective of pushing inventory upstream to suppliers." Drop shipping also has

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trading partners advantages in dealing with very short shelf life items that "cannot afford to spend time flowing through extra distribution steps or sitting in a distribution center for any length of time". Eliminating a handling step can reduce service damages for such items so that hotels providing drop-shipping services can benefit from increased sales and a reduction in advertising costs. Surveys indicate that about 30% of pure US Internet retailers rely heavily on drop shipments for order fulfillment.

2. Reviews

Many e-retailers have found that drop shipping cannot be used as the only option for satisfying demand of tourism consumers. A serious drawback of drop shipping is that a single customer order may include many services from different hotels so that the services will be fragmented. This fragmentation causes an increase in shipping costs and is annoying to most of customers. Additionally, drop shipping may have longer delivery time, which is a critical measure of customer service. Suppliers who don't set up the "handle small pick-pack types of orders" or "cannot do so as efficiently as the retailer" may not be used to drop shipping. Many e-retailers now use a mix of drop shipping and in-house inventory to satisfy demand in case of a shortage. The mixing strategy enables e-retailers to capture some of the drop-shipping advantages and avoid its drawbacks. Khouja incorporated a drop-shipping option into the single-period model framework and got that it can lead to a significant increase in expected profit. The limitation of single-period model is that it deals with perishable services and is inappropriate for many services with long shelf life. The drop-shipping option is more valuable in the single-period model than it is in the multi-period models because drop shipping allows the retailer to partially shift the obsolescence or perishability cost, which is not a consideration in the multi-period framework to the supplier.

Therefore, the authors assumed N services and N demand classes with full downward substitution and the substitution cost is proportional to the quantity substituted. The formulation results in a two-stage decision model. In stage I, the NV decides on the optimal order quantities. In stage II, after observing demand, the NV decides how to allocate the optimal order quantities among the N demand classes. Parlar and Goyal developed a two-service single-period model in which each service can substitute for the other in case of a shortage. The authors assumed that salvage value and lost sales penalties are zero and the substitution occurs according to fixed probabilities. Other models that dealt with substitutability can be found in the literature. Yao et al. considered a two-stage supply chain with a retailer and a hotel that has a direct channel to consumers. The authors analyzed inventory decisions in a centralized supply chain, a Stackelberg game with the hotel as the leader, and an outsourcing strategy in which the hotel outsource has its direct channel to a third party. Hua and Li analyzed how retail market uncertainty affects the power distribution between the hotel and the retailer in the supply chain. Yao and Liu considered price competition between a brick-and-mortar retailer and e-retailer and analyzed the pricing strategy of the hotel.

3. Study Process

The successful implementation of inventory pattern requires the establishment of several policies on return, packaging, and payment terms. The return policy should outline who is responsible for the associated cost and how returned services will be handled. The packaging tour area at contract hotel shows an array of packaging materials for different drop-shipping hotel brand names. The design of compatible information systems is another critical factor for the success of drop shipping. Achieving good customer service requires close linkage, ideally online between the hotel and the retailer. Delays in promoting customer orders from retailer to hotel will result in increased delivery lead-time to tourism customers.

The expected total annual cost function will depend on the value of R (R means the hotel receipts) relative to μ (μ means the estimation of the hotel receipts). The total cost function changes shape when $R = \mu$, because a decrease by one unit in R no longer results in an average decrease of one unit in average inventory at that level. Therefore, we develop two cost functions, one is for $R \geq \mu$ and the other is for $R < \mu$. Let U be the number of units short per cycle and $E(U)$ be its expected value. Because an average of $tE(U)$ units will be filled from the drop-shipping option, the average number of cycles per year is $D/(Q+tE(U))$. The expected total annual cost is equal to the sum of ordering, shortage, and holding costs, and the cost of inventory obtained by drop shipping and regular replenishment. If $R \geq \mu$, the expected total annual cost can be approximated by modifying the expected total annual cost of the classic (Q,R) policy. Instead of the average number of backordered units per cycle being $E(U)$, it is reduced to $(1-t)E(U)$. The average number of units drop shipped per cycle is $tE(U)$. The $tE(U)$ units incur a unit cost of p instead of the regular replenishment unit cost which is C. Because the expected amount of inventory prior to order arrival minus the expected backorder for $R \geq \mu$ is equal to $R-\mu$, the average inventory level is $Q/2+R-\mu$.

If $R \geq \mu$, the expected total annual cost is

$$E(TC) = \frac{D}{Q+tE(U)}\left|K+(1-t)SE(U)\right| + H[\frac{Q}{2}+R-\mu] + \frac{D}{Q+tE(U)}tE(U)p \qquad (1)$$

We assume that the backorder cost is independent of the length of time the order is held on the books before it is filled, which is different from previous assumptions for some (Q,R) models. This assumption simplifies the analysis and allows us to focus on the effects of drop shipping. The assumption is realistic when lead-time is short and shortages do not occur early in the lead-time. Let

$$W = t(P-C-S)+S \qquad (2)$$

Substituting from Eq. (2) into Eq. (1) and rearranging gives

$$E(TC) = \frac{D}{Q+tE(U)}(K+E(U)W \ + \ H[\frac{Q}{2}+R-\mu]+DC \qquad (3)$$

If $R < \mu$, on average the proportion of lead-time for which on-hand inventory is zero is $(1-R/\mu)$. The average duration for which inventory is zero per cycle is $(1-R/\mu)L$, and it becomes $(L-R/D)$ if $\mu/L = D$. Therefore, the average duration for which inventory is zero per year is $[D/(Q+tE(U))](L-R/D) = (\mu-R)/(Q+tE(U)$. The average annual holding cost becomes the average inventory during the non-zero inventory time multiplied by the annual per- unit holding cost, which is $H[1-(\mu-R)/(Q+tE(U))]$ accounted for the duration per year with zero inventories. For the duration within a cycle with zero inventories, averages of $(1-t)(\mu-R)$ units are backordered. Therefore, the average maximum inventory is $Q-(1-t)(\mu-R)$, the minimum inventory level is zero, and the average is $[Q-(1-t)(\mu-R)]/2$.

As the model above, not all hotel demand is satisfied and therefore a profit maximization objective is more appropriate. Let $V =$ per-unit price a retailer charges its tourism customers. While hotel selling on the web enhances hotel's ability to use dynamic pricing, we use a constant price to focus on the effects of drop shipping. The average cycle time now becomes $(Q+tE(U)/D$, the average number of units sold per cycle is $(Q+tE(U)$ and Q units have per-unit cost of C and $tE(U)$ units have a per-unit cost of P.

If $R \geq \mu$,

$$E(Z)=\frac{D(Q+E(U))}{Q+E(U)}V-\frac{D(K+S(1-t)E(U))}{Q+E(U)}-\frac{DQC}{Q+E(U)}-\frac{DtE(U)P}{Q+E(U)}-H(\frac{Q}{2}+R-\mu) \quad (5)$$

Defining $m=V-C$, $B=t(V+S-P)-S$, rearranging gives

$$E(Z)+\frac{D(Qm+BE(U)-K)}{Q+E(U)}-H(\frac{Q}{2}+R-\mu) \quad (6)$$

If $R<\mu$, then the expected total annual profit becomes

$$E(Z)=\frac{D(Qm+BE(U)-K)}{Q+E(U)}-H\frac{Q}{2}(1-\frac{\mu-R}{Q+E(U)}) \quad (7)$$

Similar to the backorder case, the expected total annual profit function changes shape at $R=\mu$ because a decrease by one unit in R no longer results in an average decrease of one unit of inventory held at that level. An algorithm can be developed for maximizing $E(Z)$ which relies on the same properties of the expected total annual cost function of the previous section.

4. Conclusion

Inventory pattern can be used by online as well as the traditional hotels to satisfy demand during shortages and also as a strategy to reduce costs and increase customer satisfaction. Inventory pattern has significant advantages over holding inventory. These advantages include savings in the cost, handling, holding, processing, and obsolescence costs for the hotel, as well as increased sales for the hotel. In spite of its advantages, drop shipping cannot be used as the only option for satisfying demand because a single customer order may include services from different hotels which will be fragmented. And this fragmentation causes an increase in shipping costs and a decrease in customer satisfaction.

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